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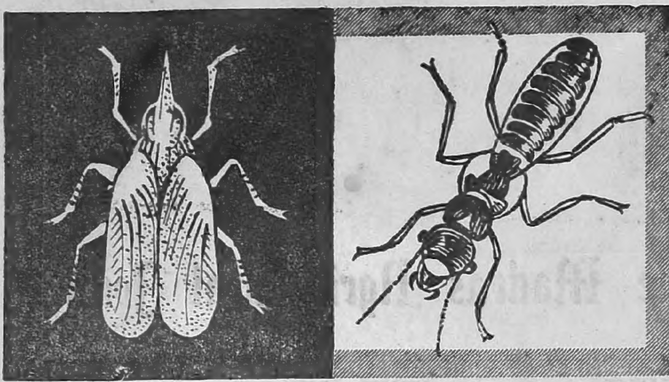

The Madras Agricultural Journal

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Editorial

New ideas on soil fertility: An extremely interesting article appeared under this title recently in the May and June issues of the "World Crops". The ideas presented therein appear to be so revolutionary that it was felt desirable that readers of the Madras Agricultural Journal should also be made aware of them. The first is the view that the atmosphere is a very dilute but quite an appreciable supplier of plant nutrients, these being absorbed by the colloidal organic matter and getting subsequently washed into the soil by rain. The evidence is furnished by the work of Ingham in South Africa. According to him strips of pure cellulose (high grade filter paper), dried grass, jute fibre, sisal fibre and even wood fibre when exposed to the atmosphere, were able to absorb appreciable quantities of ammoniacal and nitric nitrogen in all cases and under suitable conditions even lime and phosphates as well.

Based upon this investigation, it is suggested that the foliage of trees, being composed of cellulose matter, acts as a collecting agent for plant nutrients. The leaves absorb plant food materials from the dust particles of the atmosphere, rain washes them out at intervals and the enriched rain soaks into the soil below. This was subsequently tested and verified by hanging bunches of real leaves on a non-leguminous tree and also artificial leaves made of filter paper on the same tree. Appreciable quantities of nitrogen, lime and phosphates were found to be absorbed both by the real leaves and the filter paper leaves. Calculated in pounds per acre per annum, the drip from trees added as much as 23·6 lb. of ammoniacal nitrogen, 1·1 lb. of nitrate nitrogen, 338·0 lb. of lime and 22·0 lb. of phosphoric acid, (P_2O_5).

If these quantities appear to be startlingly high, it is necessary to remember that the surface area of foliage is very much greater than the soil surface area upon which the total rain falls. The concept that in addition to nitrogen even lime and phosphoric acid can be derived from the air is, to say the least, revolutionary; but this is explained on the basis that these nutrients exist as "aerosols"

or very minute particles in the air. They are in fact so small that they never settle to the ground and are by reason of their microscopic size, water soluble as well. Though the actual quantity of such particles in any given air-space may be small enough, yet because the air is constantly moving and huge volumes of air are constantly coming into contact with the foliage of trees every hour, these trees and plants can be regarded as cumulative collecting agents for the "inconsiderable trifles" of the atmosphere. The ultimate effect is literally a case of "many a mickle makes a muckle".

Incidentally this new view-point gives a more satisfying explanation of unmanured cropping than the conventionally accepted explanation of bacterial fixation of nitrogen. Ingham in fact disputes the role of *Azotobacter* as a nitrogen fixer in the soil, since he found that even as little as 10 parts per million of ammoniacal or nitrate nitrogen inhibits further fixation by these micro-organisms, besides which, for every one pound of nitrogen fixed, 100 lb. of carbohydrates are destroyed. On this basis the actual contribution of nitrogen to soils by azotobacter activity is very little and yet it is also an undeniable fact that for years together unmanured plots in long-range manurial experiments continue to give almost constant yields of crops.

Ingham's absorption hypothesis not only accounts for the nitrogen supply but also for some of the other plant-food ingredients like lime and phosphoric acid. It may also be observed in passing that British work in recent years has stressed the fact that phosphate deficiency in fruit trees is extremely rare on a field scale; and the new idea of Ingham, of foliar absorption of phosphates, seems to offer a satisfactory explanation which is more credible than the conventional view of the roots extracting phosphates from the subsoil.

It is of course needless to say that the implications of this view-point are very far-reaching and it is very necessary that workers at various centres including India should also carry out similar experiments to see how far this view is correct. It may be that different results may be obtained in different areas, such as coastal tracts, near industrial centres and in regions remote from populated areas and cities, but none can deny the need for a thorough investigation of all the varied aspects and the practical potentialities of the idea of foliar absorption of nutrients from the atmosphere.

Co-operative Farming in Practice

(An Ideal Farming Family near Guntur)

By

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When there is so much subdivision of holdings and diminished size of farms, it is a refreshing contrast to find a family of ryots not subdividing the holding among themselves, but continuing to farm the entire area jointly, and sharing the produce equitably. Our interest is heightened when we know that the number of brothers who are thus co-operating are as many as nine and not only this, they have also taken more area on lease. The total number of members of the family thus fed from this joint farm exceeds 60. It will be of interest to the readers of the journal and students of agriculture to know some details about this family of co-operating farmers.

Location and extent: The inherited area is 60 acres and the leased area 90 acres. The whole area of 150 acres is held almost as a single block within a mile of Guntur town limits on the south-eastern side. The soil is black soil, typical of the tract and the crops are all raised under rainfed conditions.

Equipment:

Iron ploughs	... 12		
Guntakas	... 10		
Gorrus	... 12	Cattle pairs:	10
Potti guntaka	... 10	Buffalo pairs:	2
Seed drills, Big	... 5		
,, ,, Small	... 6		
Markers	... 6		
Carts	... 10		

Labour: Permanent ... 15 men.

Wages Rs. 400/- per annum with three meals in the day.

Nett income for each family: The following statement gives the details of costs and income from the whole farm for the current season 1950–51 and the probable nett income in cash for each family.

Crop	Area sown	Gross income	Cost of production	Nett profit
	Acres	Rs.	Rs.	Rs.
1. Ground nut	40	12,000	4,000	8,000
2. Chillies	6	4,200	1,800	2,400
3. Virginia Tobacco	200	50,000	28,000	22,000
				32,400

Paid lease amount on 90 acres @ Rs. 75/- per acre (average)	Rs.	6,750	
Paid land assessment on 60 acres	,,	150	
Cost of production of 40 acres of grain jonna and 5 acres of fodder jonna	,,	1,500	
Amount spent in purchase of extra food grains and fodder	,,	1,000	9,400
Nett income for 9 families			23,000
Income for each family			2,500

Note: Interest and depreciation charges have not been included and this amount may be taken to be equivalent to the value of own labour put in by way of supervision and management in production.

Noteworthy features: About 60 acres every year (June—July) are grown with a variety of quick-growing green gram to be ploughed in as green manure. The cost of production of this crop is more than compensated by the value of the pulse obtained for home use. There is a corresponding reduction in the dose of farmyard manure applied to this area. The lasting benefits of systematic green manuring for these soils have been established years ago by a series of experiments done at the Lam Research Station. Departmental strains are used as far as possible, and they adopt systematic application of artificial fertilisers and also methods of pest control as advocated by the Agricultural Department. They also grow one acre of wheat for their own consumption. They have built on the farm 12 barns for flue-curing of tobacco. Besides curing their own leaves, they also purchase produce from about 30 acres for curing and disposal. The profit obtained by this means has not been included in the above statement. Each member is constructing a new house for his living at a suitable site in the farm area at a cost varying from Rs. 15,000/- to Rs. 20,000/-. In a few years' time it will be a small self-contained colony of co-operating farmers.

Acknowledgment: My thanks are due to Sri Ramanatha Rao, Agricultural Demonstrator, Guntur, for having arranged a visit to these farmers for the benefit of the students of Agricultural College, Bapatla during their tour to Guntur in January 1951.

Recent Studies in the Control of Nut-Grass
(Cyperus rotundus)

By

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Cyperus rotundus is a pernicious weed which smothers the growth of crop plants in badly infested fields, specially during the seedling stages of the crop. If the growth of the weed could be arrested by some chemical or agronomic method there will be less competition in the field, and the crop will be able to come up better.

The local method of getting rid of this weed is to work the *Guntaka* or blade harrow in the fields after the receipt of showers during the fallow period or work the country plough before the crop is sown. When the crop is on, the weeds are removed once or twice by means of chisel hoes, engaging human labour.

The spread of *Korai* in the field occurs as follows: A patch of *Korai* has green aerials above the ground surface. An inch below the ground level, lies the fresh, brownish bulb of this aerial. Connected to this with a strong string-like tissue and lower down by about 6 inches, is the second bulb which may have 2 or 3 germinating sprouts on it during wet weather. This is again connected to another bulb 5 or 6 inches still lower down in the soil, which is the third bulb. Lower still, to the entire depth of the soil the bulbs are located at intervals and connected. In a soil of 1½ feet in depth, there may be chains of 4 to 5 bulbs. The lower bulbs are bigger, blacker and look like large beetles. When such a field is ploughed with a wooden plough which goes only to a depth of 2 or 3 inches, many of the aerials with their bulbs are uprooted and disconnected from the lower ones, and the field looks as though it is free from weeds. With the next rain, two sources of infection begin to operate. The first one is the germination of the aerial bulbs which have been thrown up by the plough. These bulbs are fresh and germinate very quickly. The second bulb which is 5 or 6 inches below, beyond the ordinary depth of cultivation, germinates more slowly throwing out 2 or 3 fresh shoots and adds to the aerial population. In fact, the *korai* population after a ploughing and a rain is more than what it was before the ploughing. Some relief is certainly obtained by picking the aerials with their bulbs when they are uprooted by the plough. But this is a slow and costly method.

Deep ploughing in summer exposes a large number of bulbs and they dry up and die, which reduces the infection to a certain extent. (Krishna Rao and Moses, 1949). With this background further

experiments were attempted with a view to check the weed. Some of the phenoxy compounds are reported to be very effective in killing these weeds. Of these "Fernoxone" (or 2-4 D) has been widely used as a weed-killer and reported to have some effect on nutgrass.

To test the effect of Fernoxone in different doses on nutgrass and to compare it with the local practice of hoeing and weeding as control and thereby arrive at an effective and economic method of eradicating *Korai*, an experiment was laid out at the Millet Breeding Station, both under dryland and irrigated conditions. Areas with heavy nutgrass infestation were chosen. The average population of *korai* plants per plot at the commencement of the experiment was 175.

The four treatments tried under dryland conditions in a fallow field were :—

1. Fernoxone 0·2% aqueous solution, (3 sprayings in 2 months)
2. Fernoxone 0·5% aqueous solution, (3 sprayings in 2 months)
3. Digging to soil depth and removal of bulbs during fallow period.
4. Local Cultivation – Weeding and hoeing.

The different treatments were given for the first time on 2–14–1950. In treatmets 3 and 4, all the *Korai* plants were removed at the commencement of the experiment. In treatments 1 and 2., the plants showed no sign of wilting till the seventh day after each spraying. On the seventh day, the plants started drying and the leaves began to drop off. Within 12–15 days after spraying all the aerial growths of *Korai* plants dried up completely. The sprayings of Fernoxone were given as and when a spraying appeared necessary as judged by weed growth. Accordingly in two months' time the plots in the first and second treatments had to be given three sprayings. During the corresponding period the local cultivation plots were hand-weeded and hoed once with chisel hoes. At this time nutgrass plants were counted in all the treatments and the results are given below :—

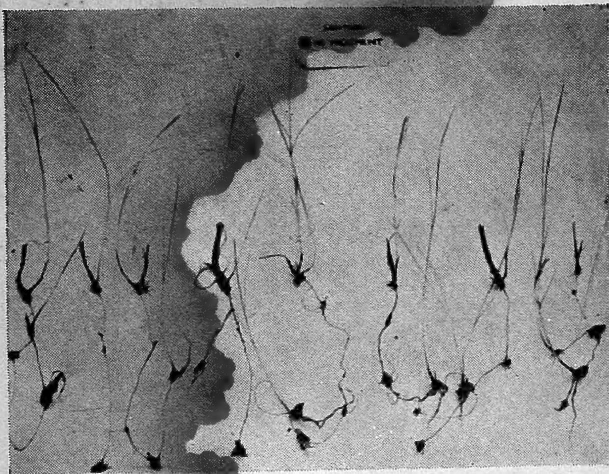
TABLE I

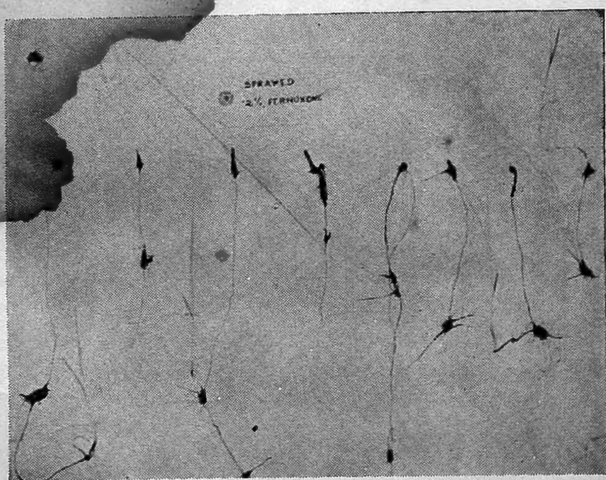
Counts of *Korai* plants (Rainfed plots)

Size of each plot — 2 yards × 1 yard (Fallow land).
Layout ... Randomised blocks.
Treatments ... 4.
Date of commencement 21—4—1950.
Date of counting 27—6—1950.

Number of new *korai* plants

Treatments	Replications 1	2	3	4	5	Total
·2% spraying	10	3	2	4	5	24
·5% spraying	4	5	7	3	6	22
Digging to soil depth and picking the bulbs.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.
Local cultivation	73	99	42	123	118	455




SPRAYED
2% FERNOXONE

There is a remarkable difference between the different treatments with regard to weed growth. The treatments killed or removed the aerial plants at the beginning of the experiment.

The new *Korai* plants that came up in the sprayed plots were very few when compared to the control plots. This indicates the amount of suppression of *Korai* that is obtained by spraying Fernoxone as compared to control plots. The third treatment i.e., digging to soil depth and removing bulbs from the soil proved to be the best method as no new *Korai* plants came up after the treatment. Hence to try this treatment on a larger scale, an area of 4·56 cents was dug to the soil depth and all the underground bulbs were removed. But the cost of digging worked out to Rs. 2,800/- per acre. Hence this treatment was rejected as uneconomic. It can however be recommended for ornamental gardens where this weed becomes a nuisance and to small-plot owner cultivators who can do the work themselves in their spare time without paying for labour.

Another experiment was laid out in an irrigated field. The average population of *Korai* plants per plot at the commencement of the experiment was 96. The first, second and fourth treatments were the same. In the third treatment instead of digging and removing bulbs the plots were left without any treatment. Here also weeding and spraying were done whenever it was found necessary. Thus the 0·2% sprayed plots received four sprayings, 0·5% sprayed plots received three sprayings, and local cultivation plots received two hoeings and weedings. The counts were taken on the same day (Table II).

TABLE II

Counts of *korai* plants (Irrigated plots)

	Number of New *Korai* Plants					
			Replications			
Treatments.	1	2	3	4	5	Total.
0·2% spraying	6	102	22	10	4	144
0·5% spraying	15	30	26	1	Nil.	72
Local cultivation	59	75	76	25	24	259
No treatment	59	260	99	156	17	521

The spraying with the weedicide was less effective in irrigated land. But here also, as under dryland conditions, very few nutgrass plants appeared in the sprayed plots after three or four sprayings of Fernoxone, in comparison to the other treatment plots.

From the above experiment, it appeared that the Fernoxone spray kills the aerials of nutgrass completely. When the dead plants were examined. it was found that their bulbs also were shrivelled. It however allows the appearance of new plants from the underground bulbs.

The next question was whether the effects of Fernoxone was confined to the aerial parts or whether it extended to the bulbs deeper down. Entire chains of bulbs including the aerial, were carefully dug out. These were kept for germination in comparison with similar but untreated *Korai* bulb-chains from control plots. The results are presented below :

TABLE III

The germination of *korai* bulbs in chains

Treatments	No. of chains of bulbs kept for germination	Germination of		
		Bulb of aerial	2nd bulb	3rd bulb
0·2% sprayed	32	2	6	4
Control	32	32	6	4
Percentage germination of 0·2% sprayed	100	6	19	13
Percentage germination of control	100	100	61	30

A duplicate set of dead aerials with their bulbs were dug out and kept for germination, with untreated *Korai* bulbs as controls. In the plots that received 0·2% and 0·5% spray of Fernoxone, the germination of the bulbs of the aerial was 8 to 12%. In the case of control plots where no spraying was given the germination of aerial bulbs was 92%. Photographs of the chains of bulbs have been appended.

It is seen from the above data, that the lower bulbs are slower to germinate, while the bulbs of the aerials germinate more quickly. Spraying kills practically 90% of the bulbs of the aerials and to a certain extent suppresses the germination of the second and third bulbs also, and thus delays the appearance of new shoots. This gives relief for a longer period during which time the crop is given a chance to come up without weed competition in the early stages.

To see whether spraying *Korai* with 0·5% Fernoxone during the seedling stage of a crop has any effect on yield, consequent on the reduction of weed growth, two plots of 29 links × 20 links each, which had equally heavy and uniform infestation were marked in a large infested area and one was sprayed with 0·5% Fernoxone and other was kept as control and not sprayed. Spraying was done 18 days after the dryland cholam crop was sown. The cholam seedlings were about one foot high and there was a lot of *Korai* on the ground, the aerials being 2 inches high. Ten days after spraying, *Korai* plants in the 0·5% sprayed plots wilted and dried. The control plots continued to have heavy weed growth. The plot yields taken at harvest are recorded below :

TABLE IV

Yield of plots under treatments

Treatments	Weight of dry straw lb. oz.	Weight of dry earheads lb. oz.	Weight of grain lb. oz.
5% spray	11 — 0	1 — 9	1 — ½
Control (no spray)	7 — 10	1 — 2	0 — 9

The yield in the sprayed plots was 83% higher than in the control plots.

Spraying may thus be given within the first month of the sowing of the crop. In the fallow period a deep ploughing has to be given to destroy as many nuts as are thrown out. A combination of these two controls the weed effectively. Further work is needed to know the effect of continued spraying of *Korai* plants in the same plot over a period of three or four years.

Summary: In the control of *Cyperus rotundus,* by spraying Fernoxone with 0·2% and 0·5% strengths (i.e. 2 gms. or 5 gms. in 1000 c. c. of water) in the fallow period, it was found that two or three sprayings reduced the weed population to about 5% of what it was in untreated plots. It was more effective in drylands than in irrigated fields. Fernoxone spraying killed 90% of the bulbs of the aerial plants and suppressed the germination of the second and third bulbs lower down to a certain extent, thus giving relief for a longer period. In drylands it was found that one spraying of Fernoxone given when the sorghum crop was about a month old, killed the weed and increased the crop yield by about 83%.

LITERATURE CITED

Krishna Rao, P. and Moses, L. (1949) Effect of summer ploughing on the germination of "Korai weed", *(Cyperus rotundas),* Madras Agri. Journ., Vol. XXXVI. No. 6. page 247.

EXPLANATION OF PLATE

In the sprayed plots the bulb of the *Korai* aerials (which are ranged in the first line) have failed to germinate (except in one instance at the right), due to the effect of the treatment. The germination of the second bulbs is also slack. In the control-no treatment plot, the bulbs of the *Korai* aerials (which are also ranged in the first line) have germinated vigorously. The second line of bulbs have also germinated in many cases.

Korai = *Cyperus rotundus* (Nutgrass)
Cholam = Sorghum crop.
Guntaka = Blade harrow.

Problems of Low-Income Farmers

By

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It is a well-known fact that nearly three-fourths of India's population depend on agriculture for their living. Nearly 70 per cent of these cultivators have uneconomic holdings. Cultivation of land taken on lease, is therefore widespread and about 50 to 60 per cent of cultivators are tenants at will, sharing their produce with absentee landlords, who very seldom render any useful service in the cultivation of their lands.

Madras had a population of 49 millions in 1941 and this is increasing at the rate of nearly one million per year. Almost two-thirds of the cultivated area of 39 million acres in Madras is owned by cultivating farmers who pay less than Rs. 30/- each assessment on their holdings. The average size of holdings range from 0.63 acres to 6.5 acres, with a mean of about 3 acres. The richer class in agriculture, who pay over Rs. 100/- as land assessment, own about 14% of the cultivated area; their holdings range from 40 acres to 305 acres, with a mean of 60 acres. The majority of the cultivating classes are farmers of small holdings with a low income. This income is also deteriorating day by day. The holdings are getting smaller as the years go by, due to division of property. The partition of ancestral property in accordance with the existing laws of inheritance, is the main cause for the small size of holdings and the uneconomic returns obtained from the land. This type of farmers owning small areas, take up tenancy farming and also seek other supplementary avocations to eke out their incomes. Agricultural incomes in general, not only fail to show any increase in recent years but have actually been falling in many parts of the country, in spite of the increase in area under irrigation. Even the recent unprecedented rises in the prices of agricultural produce have not brought any substantial relief to the cultivators, as a vast majority of them produce only for their own consumption and have hardly any surplus for sale, to be able to benefit by the higher prices. On the other hand, most of them have lost a good deal during this period owing to the higher costs of their requirements. The bigger landlords have no doubt benefited to some extent, but the vast majority of tenants, labourers and uneconomic landholders and share-croppers have been left poorer by the war. Thus our agricultural strata comprise a small minority of large landholders at the top and a vast majority of uneconomic landholders, tenants and labourers at the bottom.

The problem of relieving the pressure of population on the land resolves itself into one of rapid industrialisation and secondly of reorganisation of the agricultural economy of the country. Surplus labour in agriculture should be drawn into the industries. Cultivation methods should be modified so as to increase the productive capacity of the farmers. Measures should also be taken to bring more area under cultivation, by reclaiming the 90 million acres of waste lands, with the aid of facilities offered by the International Monetary Fund.

At present all the facilities available for increasing crop-production are not fully availed of by the majority of cultivators. The achievements of agricultural research are not sufficiently appreciated and are not fully translated into general farming practices. The innate conservatism of the farmers, reluctance to adopt methods new to him, and his chronic poverty, these are some of the reasons that are attributed for the slow spread of agricultural improvements.

As an outcome of detailed enquiries made in villages, some of the main reasons for the slow spread of improvements and the possibilities of hastening the spread are dealt with in the following paragraphs.

Ignorance, lack of finance, and non-availability of the materials for improvements in time, these are the main handicaps of ryots. They are also conservative and often lack any incentive to improve their status, though in recent times this tendency is receding. Ignorance on the part of the farmers about the achievements in improvements indirectly reflects on the inadequacy of the organisation for propaganda. Convincing demonstrations of improved methods are the best means of translating the results of research. Educating the ryot on the benefits of improved methods and awakening him from the slumber of centuries of ignorance, should form the primary duty of the State.

Availability of improved seeds and plants of different crops and their utility should be brought home to the ryots more widely than is done now. Sufficient quantities of such improved seeds should be made available within easy reach of the ryot. Inadequate supplies and distant transport damps the enthusiasm of even enlightened ryots. The cost of such improved seeds should be kept low, by subsidies if necessary, so as to be within the easy reach of the low income group of farmers. Even ryots who are aware of the benefits of adopting the improvements suggested, get disappointed, if the supply is inadequate or not available in time. It often happens that the low income farmer is hit hard and fails to get the full benefit if attempts are made to ration the limited supply of improved seeds. A continued spell of meagre supply is likely to create not only an antipathy towards the organisation, but also destroy the incentive to improvements.

On account of their low income levels farmers are not able to avail themselves of all the improvements now put before them. Costs in many cases appear to be prohibitive to the small farmer. Credit facilities from

co-operative organisations have touched only a fraction of the needs of the country and have not become a good substitute for the village money-lender. Quick availability of finance, as it now obtains in the case of the village money-lender, without too many formalities to guarantee the credit-worthiness of the borrower, should be provided by the co-operative credit societies also.

The next and perhaps the most important handicap is the existence of uneconomic holdings. These holdings in addition to being small are often scattered over a large area. Improvements are difficult in small and scattered areas, particularly for share-croppers; while the tenancy system creates no incentive for improving the yields or income from the land. A radical change in the system of inheritance, which now perpetuates the fragmentation of holdings, should be brought about speedily. A system of inheritance like that of primogeniture or the preferred-heir-system as adopted in western countries may be tried. Existing holdings may be made compact, even by compulsion if necessary and economic units fixed for each region in the country, taking into consideration the fertility of the soil, nature of cultivation, climatic conditions, irrigation facilities, etc. Division of land beyond a certain economic limit can be prohibited by law. Crop-sharing system can be put an end to and replaced by cash rentals or a fair rate of interest for all the investments made, including improvements. Cultivators may also be discouraged by law from raising credit on the security of the land for unproductive purposes. These would prevent change of lands from agriculturists to non-agriculturists.

Other factors that stand in the way of agricultural improvements will easily get resolved if the most important ones mentioned above are overcome.

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